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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

BRANCH OF RESEARCH

MONTHLY REPORT

OF

FOREST EXPERIMENT STATIONS
FOREST PRODUCTS
FOREST ECONOMICS
RANGE RESEARCH

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BRANCH OF RESEARCH

September, 1932

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APPALACHIAN FOREST EXPERIMENT STATION

Bent Creek Forest

A fourth laboratory unit, duplicating those already built, is under construction at Bent Creek. A telephone system is to be installed which will connect all the buildings on the forest in such a way that any one of them may be connected with the Forest Service line to Asheville, and so that independent communication between buildings is possible.

A fire code for the forest was drawn up and agreed upon by the Bent Creek Committee. It contains rules for procedure when fire is reported on or near the forest. A gasoline fire pump, ordered in June, has been received and is stored in the garage ready for use.

During September Buell and Manchester checked over the reports on sample plots on the forest and made a complete file of them to be kept at Bent Creek. A set of cards was made which shows all the experimental work which is being carried on in each compartment of the forest, and a map was prepared on which all sample plots are located, the different projects being distinguished by a color legend.

Three weather stations were established on the Bent Creek Forest, located under forest cover on a fairly even northwest slope at elevations of 2100, 2300 and 2500 feet. At each there are a hygrothermograph for weekly records, a maximum and a minimum thermometer, and thermometers placed in the soil at 6", 12" and 24" depths. The effects of local variation in altitude on air and soil temperatures and phenological phenomena are to be studied.

Forest plantings

Sims and Abell visited the plantations of the Champion Fibre Company at Willetts, North Carolina. About 300 or 400 acres were planted by the company in 1927 and 1928. Scotch pine plantations made at that time now average 5-1/2 feet high. In a 5-acre white pine plantation many trees were 14 feet high and showed growths of 3 feet or more between whorls of branches. Yellow poplar plantations averaged 4 feet high.

Forest management - mountains

The methods of cutting, and chestnut replacement plots on the Natural Bridge and on the George Washington National Forests were reexamined.

The party moved to the Bent Creek Forest and established quadrats in the three plots in the oak-pine type which were cut over last winter. The cutting, which covered 17-3/4 acres, was the first step in the conversion of the stand into pine standards with hardwood coppice. It removed 17-1/2 cords and left 10 cords per acre.

(Over)

A new scheme was used for quadrat mapping on these plots. A frame of white pine lumber, about 1 x 2 inch material, was constructed which has inside dimensions of 5 x 10 links. All four sides of this frame are marked in links and 10ths of links. Two wooden riders are used the long way of this quadrat frame to more exactly locate seedlings. These strips are also marked in links and 10ths of links. The quadrat frame was used flat on the ground and so the area within it is slope area instead of horizontal area. The frame was held as a rigid rectangle by two diagonal strips until all four corners had been secured by iron stakes which were left as permanent markers of the quadrat corners. Seedlings were designated by their X and Y coordinates instead of by numbers. Work was begun at the 0, 0 corner of the quadrat and all seedlings in a strip one link wide were located across the long way of the quadrat. The upper boundary of this link-wide strip was designated by one of the riders mentioned above. When this first strip had been completed the second rider was placed 1/10 of a link beyond the first rider and the seedlings in the second strip were described from left to right.

On each of the 3 plots in the oak-pine cutting 20 of these half-milacre quadrats were established. They were well distributed over each of the plots, one of them being established in each of the half chain squares into which the plots had previously been divided.

Early in September five quadrats were established in a stand of pine-oak adjoining Bent Creek Forest where the undergrowth had been cut and the soil broken last spring by plowing to a depth of about 4 inches, and where a great many pine seedlings have already appeared and grown in some cases to be as much as 5 inches tall. Five other quadrats were established in an undisturbed stand of pine-oak. It is planned to follow the seedlings on the two sets of quadrats for the next 3 or 4 years in order to compare the stocking and rate of growth.

There were also examined eight chestnut replacement plots on the Bent Creek Forest. This examination included remeasurement of reproduction quadrats, major stand, and sprouting of chestnut trees and stumps. In addition reproduction was examined on 50 square rod plots surrounding chestnut stumps and sprouting data obtained, each group of 10 stumps having been treated in a different way at the time of cutting in 1926.

During July and August Buell completed reports on the experimental cuttings made on the Bent Creek Forest during the winters of 1930-31 and 1931-32. Barrett completed a report on the yellow poplar stand in Sosebee's Cove in North Georgia, and spent a part of July on computations connected with the establishment of white pine release plots on the Cherokee National Forest.

The Glenn Sale Area on the Pisgah was visited. Here sale area betterment cuttings are being made by the National Forest. The work consists of (1) liberation cutting in which all undesirable holdovers are girdled or felled but desirable species are left, along with groups of immature holdovers of good species, and (2) a cleaning which cuts sprout clumps of all undesirable species except chestnut. It is assumed that the chestnut blight will hold down chestnut sprouts so that they will not offer much

Little is actually known about (1) the best time of the year to girdle, or (2) the best technique, i.e., the best place for the girdle on the trunk and whether to peel a wide strip or to notch well into the wood in a narrow strip. One workman believes that the thicker the sapwood the more difficult it is to kill a species by girdling; chestnut and oak are easy to kill, but red maple and black gum are difficult.

On the Poole Sale Area betterment work had been done the previous summer. Most of the large trees had been felled but a couple of large black gums (24") from which girdles of bark 6" wide had been cut were seen. In both, new callus was growing across the girdles of bare wood and in one case a callus 2 or 3 inches wide bridged the cut. In both cases the trees were alive, but the foliage was rather thin and yellow green. A hickory similarly girdled was also alive but showed no callus growth. These observations seem to show that the mere removal of bark is not sufficient to kill species with thick sapwood.

Fire studies

Approximately 20 acres, within the boundaries of 5 plots, were set aside at the Bent Creek Forest for controlled burning experiments. On these plots over 6,300 trees were tagged or tallied and described. In addition approximately 300 half-milacre quadrats for reproduction studies were established. If conditions are favorable, a part of the area will be burned this fall. The main purpose of the experiment is to determine the effect of fire on basal area, growth, and reproduction. At the same time data will be obtained on fire temperatures, influence of fuel and topography on the severity of fire, susceptibility of different species to basal wounding, relation of diameter to mortality, and influence of fire on growth and establishment of laurel.

The field work involved at least 2 innovations in sample plot procedure in the mountain hardwoods; first, on the plot to be burned, trees 1.6 inches to 3.5 inches d.b.h. were described but not tagged, and , second, the data were taken by 0.1 acre (1 ch. x 1 ch.) sub-plots. The first departure from ordinary practice was made because heavy mortality is expected in the small classes following the fire and considerable time was saved by not tagging the small trees. The second departure is expected to yield more flexible and therefore more useful data.

Experience on these plots indicates that the trees on 3 to 5 tenth-acres can be tagged and described per man-day. No great difference was found in the efficiency of 2 and 3 man crews. The work consisted of nailing a tag on the tree at a measured height (5 ft. above ground), measuring d.b.h., measuring and describing old fire wounds, and noting vigor and crown class. Height measurements were not taken because of the difficulties involved in seeing through the heavy canopy of leaves.

The manuscript of the basal damage study was completed for publication and the plan for the project was revised.

Streamflow and erosion

The 10 permanent installations for studying stormflow from different types of vegetation cover on the Bent Creek experimental forest have been operating during the summer months with gratifying success. The greatest variation between vegetation types occurs between the undisturbed oak-pine type and adjacent oak-pine type from which the litter has been removed during the past 3 winters. Studies using artificial precipitation indicated that the soil saturation coefficient could be determined for a given location above which additional precipitation is removed by stormflow, as subsurface flow within the upper soil horizons, although no actual superficial runoff was observable. Evidence has been obtained that the character of the humus layers of the soil determines the amount, depth, and rate of absorption of precipitation.

The entire set of 10 plots are being observed closely during the present rainy season and all runoff as stormflow is being measured after each storm. The intensity of precipitation is being recorded by standard 12-inch Weather Bureau tipping buckets and automatic recorders. The data obtained so far are being prepared as a preliminary report.

Forest insects

The dry weather of the spring and summer was favorable to the development of Dendroctonus frontalis. Outbreaks were reported from Lake City, Florida, Hot Springs, Arkansas, Charleston, South Carolina, and Asheville. At Bent Creek the attack upon about 150 pine trees gave the opportunity for experiments to determine the minimum dosage of injected poisons, previously found effective, which would kill the beetle. Experiments in killing the beetle by spraying the bark of the trees with various chemicals showed promising results. More work, however, is necessary to show whether the brood can be killed and the tree saved at the same time.

The study of the interrelation of the Dendroctonus and blue stain fungus in causing the sudden death of pine trees was continued. Considerable attention was given to the change in moisture relations of attacked trees that occurs as they begin to die and the way in which this change affects brood and blue stain development. Data were collected for a careful comparison of different methods of making moisture determinations in the tree studied. The methods included cross sectioning, increment borer and auger borings, and chipping of annual rings with a knife.

The results of an experiment in wood preservation begun in 1930 and 1931 were observed. Standing live trees had been injected with various poisons and later felled. Two sections were cut from the base of each tree, two from the middle, and two from the top. One of each of these pairs of sections was buried and the other allowed to lie on the ground. It was found that the treatments were effective in preventing the attack of insects and fungi.

R. A. St. George was in charge of the work described above. He was assisted by R. W. Caird, B. J. Huckenpahler and L. E. Peterson. Dr. W. C. Bramble of the Bureau of Plant Industry cooperated in the physiological studies.

Forest Biology

During the summer Burleigh continued his faunal studies of the Southern Appalachians. He made trips to the coastal regions of North and South Carolina as well as many shorter trips into the mountain region.

At Bent Creek he began a study of rodent habits. The animals were trapped alive, and marked, in order to learn of their normal wanderings. These data are needed in obtaining the average rodent population in the forest.

The fall movement of birds was closely watched with the result that valuable information on less common and comparatively unknown species were obtained.

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CENTRAL STATES FOREST EXPERIMENT STATION

General

The additional space allotted to the Station by Ohio State University was equipped for office use and ready for occupancy by June 15. Portable partitions, dividing the large room into four offices, were installed early in September.

Copeland Report

As a result of the Copeland Senate Resolution, which called upon the Forest Service to furnish a comprehensive report on the nation's forest conditions and problems, the entire staff of the Station necessarily devoted practically its entire time to this project after the first of August. District Forest Inspector E. M. Bruner spent a week at Columbus cooperating in the preparation of the report, and contributed several sections dealing with his phases of the work. Extra stenographic assistants were employed. Most of the Central States section of the report has been finished and submitted to Washington, and the rest of it will be completed during the first week in October. From the nature of the information asked for, cooperation was required from the various state and local forestry officials, and other organizations and individuals who had information dealing withsoils, erosion, streamflow, land use, recreation, fish and game, and other phases of the forestry problem. Many contacts with cooperators were made in connection with field trips already mentioned, but a number of special trips were also required. Kellogg spent several days in Iowa; all other members of the staff made contacts in the other states of the region.

The time required for the preparation of this report resulted in some curtailment of field work on the regular research projects. Fortunately the field crews of the locust plantation study and the woodland grazing study were composed of experienced and competent assistants, so that their work could be continued throughout the season with a minimum of supervision.

One very beneficial result of the Copeland Report has been a much better understanding of the forest conditions and problems of the region.

Walnut Plantation Site Study

A study was made of the site properties and characteristics of the walnut plantation plots previously established by Kellogg. The new Ford truck with delivery body was equipped as a field laboratory, and in addition to soil profile examinations and sampling, pH determinations were made potentiometrically. The purpose was to determine those qualities of soil and site that result in good or poor growth of black walnut.

Walnut caterpillar (Datana integerrima)

Unusually severe damage from the walnut caterpillar has been observed on walnut, both native and planted, in Indiana and Illinois this year. The worms were first noted about July 18 in Ohio, and by August 1 none of them remained to be found in Illinois. Damage first became apparent and was noted by Craig on July 21 near Urbana, Illinois. It becomes more serious west of Clinton, Illinois, and is very severe farther west. Kellogg noted almost complete defoliation on trees and stands across mid-Indiana and Illinois. In the Wabash Bottoms and in southern Indiana the damage apparently was done earlier and a second crop of very small leaves was produced. Whether the heavy nut crop this year will be normal in maturity and viability on defoliated trees is a question to be determined.

Black Locust Yield Study

The field work of locating and measuring planted black locust yield plots has continued through the summer. This year the data on locust yield and borer damage were obtained by the one field crew. This year's work first completed the establishment of plots in Indiana, and later on covered the locust plantations in Illinois, Tennessee, and Kentucky. Seventy-one plots were established as follows: Indiana, 30; Illinois, 7; Kentucky, 6; Tennessee, 28.

In Indiana and Illinois, and in Tennessee on the thin, poor soils, severe damage from past drought was very evident. In Indiana, a majority of the locust stands, north of a line from Vincennes to Richmond, are stag-headed, a condition commonly attributed to the 1930 drought. Last year this condition was not so evident. In general the stands apparently suffering most are those on the poorer sites, with less vigor prior to the drought. In some localities in Illinois trees were killed outright, and some stands were found where relatively few trees now remain alive.

Black Locust Stem Measurements

Because of little or no cutting of plantation black locust in the region at the present time, volumetric measurements were necessarily secured by climbing, as was done in the case of black walnut measurements in 1931. 394 measurements were obtained: Ohio 187, Indiana 182, and 25 in Illinois.

Locust Borer Investigation

Dr. Hall reports that the observations made on an eastern trip through New York and Massachusetts confirm the findings of the 1931 work in the Central States, namely, that quality of site is closely correlated with locust borer injury. Many examples were found of severe injury on locusts growing slowly on poor sites, whereas in rapidly growing stands on good sites, borer injury was generally negligible.

The locust yield crew, after covering the state of Indiana, reached the conclusions that the borer attack in northern Indiana is of relatively recent occurrence, whereas in southern Indiana it appears to have reached its height in former years, and the present borer population seems to be endemic. In many plantations in southern Indiana the stems are gnarled and bumpy, the result of recent growth covering the scars and deformities caused by severe borer damage in former years.

For the most part, locust plantations are scarce in Illinois, farmers having refrained from planting in recent years. Many of the locust plantations in southeastern Illinois have either been killed by drought or badly riddled by borers.

Young plantations in western Kentucky and Tennessee appear to be doing well -- somewhat better on the average than those in Indiana and Illinois.

Woodland Grazing Study

The second year's tests of the livestock carrying capacity of oak-hickory woodlands is being conducted at the Pinney-Purdue Farm at Wanatah, Indiana, in cooperation with the Purdue Agricultural Experiment Station.

Last year it was found that grazing intensities of two and four acres per animal (steers) were incapable of even sustaining weight over a six months' grazing period. In the two-acre-per-animal pasture, the steers had to be removed late in July to prevent loss of weight beyond the point of recovery. The four-acres-per-animal unit permitted a fair gain of weight during two-thirds of the season, but lost this gain to a point below the original weight of the animals during the last two months. In the six-acres-per-animal pasture there was a fair gain of weight until October, when most of this gain was lost.

Since the accumulation of several years' growth of foliage and grass was completely utilized by 1931 grazing, it was anticipated that this year's tests would show even less carrying capacity. This year the pastures are more nearly in the condition of the average over-grazed woods in the region.

In the two-acre-per-animal tract, the steers lost weight almost from the start of the season, and were removed to prevent harmful results. The steers in the four-acre-per-animal pasture were removed about September 1 for the same reason, and it is expected that those in the six-acre-per-animal tract will have to be removed early in October. A complete report of the season's tests will be made next month.

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Field work is still in full swing and not much has come in in the way of specific reports of accomplishment.

On the two experimental forests in the White Mountains the inventory surveys have been completed and a number of permanent sample plots are being established in connection with studies of management of spruce and growth and yield of northern hardwoods.

Both of these forests were in line of the belt of totality during the recent eclipse of the sun. Detailed observations of meteorological conditions during the afternoon of the eclipse were made in cooperation with Professor C. F. Brooks of Clark University. Cloudy weather interfered with observations of the eclipse to a certain extent but conditions at totality were fairly satisfactory at Gale River.

Reineke has designed an ingenious device for facilitating the counting of hardwood increment cores. The instrument consists of a metal clamp about one-half the thickness of an increment core, which holds the entire core firmly so that it can be cut off with a sharp knife on opposite sides. When cut in this way the annual rings show up very plainly by transmitting light, and the results are far superior to those obtained by the use of phloroglucin stain.

Stickel's report on the fire-weather study at the Petersham station has been completed. It is hoped this may be published by the Harvard Forest which cooperated in the field work. An eight-page summary of the report has already been published and distributed by the Massachusetts Forestry Association. Publication in this fashion was made possible by subscriptions by a number of the states for a large number of copies.

Progress reports on the cooperative survey of the distribution of the European pine shoot moth, which was suggested by the Northeastern Forest Research Council, indicate that the insect has not yet appeared in Maine, New Hampshire, and Vermont. It is fairly well distributed in western New York and in Connecticut. The insect situation in Massachusetts is somewhat in doubt but no new infestations have been found other than those on ornamentals in Boston in the Metropolitan district previously reported. Although attacks in heavily infested districts have jumped from very little to almost one hundred per cent in some cases, the situation does not appear hopeless and vigorous control measures in the early stages should prove practicable.

The seventeenth meeting of the Northeastern Forest Research Council was held at the new quarters of the Station in New Haven on August 29 and 30. The program covered forestry activities as a source of unemployment relief, and the Copeland Resolution. Reports from the various states indicate that public forests offer a very large and varied opportunity for work in unemployment relief but that the effectiveness of such programs depends almost entirely on the ability to keep it free from politics. It was agreed that foresters should take the lead in showing the opportunity for constructive development in this field and in encouraging the various agencies to have definite plans for the future which could be developed as emergency situations arise.

Discussion of the Copeland Resolution brought out a strong feeling for independent state action in the eastern territory. The feeling seemed to be that federal aid is entirely sound as a means of laying the foundation for economic development along certain lines and for the protection of property, but that the difficulties in federal aid programs lie in the establishing of proper limits for federal action and for working out practical schemes for withdrawing the aid when the objective has been reached in any state.

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NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Silviculture

Haig left the Station early in September for nine months' educational leave to begin work for his doctorate degree at Yale Forest School. Haig was occupied during the summer with what, for the want of a better name, is being called the white pine seedling survival project. This is an elaborate installation of sowed quadrats under three conditions of overhead shade referred to as full-timbered, half-cut, and clear-cut, and representing 5% sunlight, 28% sunlight, and full sunlight. The primary object of this study is to determine the relative influence of each of the more important physical factors of site on early seedling survival in the western white pine type. The principal factors being studied are light, temperature, soil moisture, precipitation, and character of soil surface.

Some interesting preliminary results are available from the summer's work. Total mortality of the one-year white pine seedlings has been 58% under clear-cut, 19% under half-cut, and 47% under full-timbered conditions. Particularly interesting are the results of losses from drought and surface soil temperatures. On the clear-cut area the losses from high surface temperatures amounted to 28% and those from drought, 1%. Under full timber there were no losses from high surface temperature, but 11% mortality from drought. Root penetration and soil moisture at different levels explain the anomaly from the standpoint of drought. By the end of July the white pine roots had reached a depth of 8 inches on the clear-cut area as against only 2-1/4 inches on the full-timbered area. Soil moisture was critically low in the 0 to 3-inch level under all conditions of shade by midsummer. The seedlings growing in the open had stocky, sturdy tops capable of photosynthetic activity adequate to support root penetration to deeper and moister soil levels. On the other hand, the seedlings under full timber had very weak and slender tops (reflecting the deficient amount of light) and consequently were incapable of supporting deep root penetration. The loss of shallow-rooted seedlings like cedar and hemlock under full timber was naturally much greater than that of white pine.

Maximum surface soil temperatures naturally varied under the three conditions of shade. During the warmest period of the summer, from July 20 to 30, the maximum surface temperatures on mineral soil ranged from 123° to 146° F. on the clear-cut area, and from 77° to 142° on the half-cut area, with one exceptional reading of 158° on one of the quadrats of

the latter area. On the full-timbered area the maximum temperatures on mineral soil for this period ranged from 66° to 82° F. By different surfaces, the average maximum temperatures reached during a 20-day period in mid-summer were as follows: duff, 146° F.; mineral soil, 134° F.; burnt mineral soil, 136° F.; charcoal surface, 136° F. During July and August the record shows only seven days on which surface temperatures in duff were under 120° F. on the clear-cut area. White pine seedling mortality for all the quadrats was 70% on duff, 38% on mineral soil, and 38% on burnt mineral soil.

During the past season a study of evaporation rates, as measured by Livingston porous porcelain spheres, and transpiration rates, as measured by white pine transplants and sunflowers, has been conducted in connection with the survival stations. The evaporation rates have been, roughly, in the ratio of 2 to 1.5 to 1 on the clear-cut, half-cut, and full-timbered areas respectively. No data are available as yet on transpiration rates, and only partial data will be available at the end of this season due to premature death through insolation of all sealed phytometers on the clear-cut area.

Two sets of reproduction quadrats were established on so-called hemlock disposal areas on the Kaniksu. Hemlock disposal is a type of silvicultural treatment by which the defective material in climax stands is felled and broadcast-burned following logging of the sound and merchantable trees. Restocking, if it is secured naturally, must come from scattered larch seed trees which can survive the fire, and through seeding from the side. Fifty-four milacre quadrats were installed on one 160-acre area treated in this way and 28 milacre quadrats on another area of about 40 acres. The purpose is to determine the rate and character of restocking following this method of cutting. In addition to the quadrats, two lines with a total of 25 seed traps were installed to get better information on distance of effective seeding from the side in the white pine type.

To get some much-needed data for forest management plans, for the Forest Survey, and for purposes of private forestry discussions Weidman obtained some preliminary measurements of increment of residual tree growth following logging in the larch-fir type. The main object is to be able to predict the second-cut possibilities following selective logging on timber sales and private cutting operations. The project was originally planned for execution by short assignments of rangers from larch-fir National Forests, both as a training measure and to get the needed information. The Experiment Station will supervise and instruct in carrying out this work.

As a part of the cooperation between Silviculture and Products and other agencies near Missoula, a set of selective logging plots were established in ponderosa pine. Dunning's tree classification system was used, it is believed, for the first time on work of this sort in Region One. The system seems to apply to ponderosa pine in western Montana very well except for some slight modification in the age limits set for young, thrifty mature, mature, and over-mature classes as determined for California. This is made necessary because of the slower growth in Montana. On the other hand, a great deal of difficulty was experienced in an attempt to adapt the system to Douglas fir, which occurs in the stand both as an overwood

tree and rather heavily in the understory. Due to the difference in tolerance, individual Douglas firs have all the characteristics of No. 1 and No. 3 trees, and yet fall short of the described requirements from the standpoint of dominance of crown.

The installation includes three plots comprising clear-cutting, economic selection, and silvicultural selection. The total of 18 acres includes an aggregate of about 1800 trees over 4 inches d.b.h.

Measuring Fire Danger

Distribution of the Fire Danger Meter to Supervisors in April resulted in the largest expansion of field work in measuring fire danger since this project was commenced in 1922. With the Meter available to integrate the six most important factors of fire danger, field men were quick to recognize the fact that the greatest error was likely to be injected by guesses concerning fuel moisture and inflammability. As a result, requests for duff hygrometer or wood cylinder stations were received by the Experiment Station from all but one of the western Forests in Region 1.

Furnishing the equipment for these stations completely exhausted the supply of wood cylinders and duff hygrometers calibrated and in stock at Priest River. Consequently a new supply of wood cylinders was ordered, oven-dried, and is now being field-checked at Priest River to furnish fifty stations with three sizes of wood cylinders. About 230 cylinders are now being compared so that all stations can be supplied in 1933 with calibrated specimens guaranteed to integrate all the weather elements, with a variation of not over 1% in moisture content, when exposed to similar weather.

As there are now 23 inflammability stations in Region 1, seven in Region 4, and two in the Parks, the refurnishing of these 32 stations, together with meeting the demand for new stations, results in an appreciable volume of work this year.

As results from the numerous stations equipped to measure fuel moisture this year, we have an excellent picture and shall be able to compute a dependable index figure of the character of the 1932 fire season. From the fuel moisture charts submitted to date it is clear that 1932 was an easy season partly because of the frequent favorable breaks in the form of rain which resulted in only one moderately protracted period of danger. This was from July 15 to 30 at the most favored stations, and from July 5 to August 10 at the worst. The records also show, however, that between rains practically every station experienced one or more periods of extreme dryness and inflammability, in some cases rivalling the conditions of 1931. Such measurements prove that the excellent fire control record of 1932 was not purely the result of favorable weather, but was due also to high efficiency that prevented big fires during the critical periods.

Jemison left Missoula for a long detail to Washington. His principal work there will be on one phase of the statistical analysis of the weather and fuel moisture data obtained at Priest River during the last eight years. All of these data have been transferred to punch cards, and Jemison will make a complete examination of concurrent duff moisture and wood cylinder

moisture according to prevailing weather, and as influenced by three degrees of forest canopy. In addition, he will represent Gisborne in Washington in the complete analysis of all these data so that a new report can be prepared on the measurement of fire danger in northern Idaho.

As yet nothing more than opinion has been received concerning the Fire Danger Meter, which was supplied to the fire Forests. The reception of this device has been decidedly constructive, practically all of the men from rangers to supervisors being anxious to give it a trial. Unofficial comments received indicate that the Meter sometimes showed more action needed than experienced opinion believed necessary. This will be checked in detail by the analysis of the Meter rating and the actual action for each day. If it is found that the Meter rating favored too much expense and action, changes can be made to prevent this in the future. On the other hand, until the present Meter is tested throughout a truly critical fire season it will be dangerous to reduce the ratings for fear of failing to indicate sufficient action during a critical season. These points, however, are minor compared to the experience of the past season which showed clearly that a device of this kind, using present methods of measuring the various factors, is welcomed by the field force and found helpful.

One other research development of the past season has also been very favorably received by the field. This is the "wet area map" idea, first conceived by Hornby as a method of grouping fire reports according to similar weather, and later developed into a method of currently rating fire danger. When the possibilities of this method of knowing danger spots were described to the field, the reaction was almost instantaneous. As a result the western Forests in Region 1 ordered, from their own funds, 217 Forest Service rain gauges during the past season, and the expression "a darned good rain" has been rendered practically obsolete by the present reports to the nearest hundredth of an inch. Practical results of these measurements and cases of changes in the placement of men on the basis of this information are too numerous to name.

Transportation and Man-Power Placement

The dependable speed and the truck-type capacity of roads on the northern Idaho Forests was determined. At the same time a method of classifying and mapping fuel types was developed. Visibility mapping will be completed for three Forests and nearly completed for three or four more Forests by the close of the season. About 50 field mappers were used on this phase of the man-power placement study.

A detailed study of area burned on the Clearwater has shown some interesting results. According to the data obtained by the intensive fire survey on the Clearwater, made in 1921 and 1922, and the fire records since then, about 67% of the total area has been burned one or more times since 1860. Of this area burned in 72 years, 82% was burned in four years and 61% in one year (1910). This clearly shows the tremendous importance of the bad fire year in this Region. From 1910 to 1931, inclusive, an acreage equal to 71% of the gross area of the Clearwater was burned over. Of this, 70.6% was single burn, 27.3% was a second burn, and 2.1% was a third burn, or 29.3% was reburn.

Forest Survey

Adjustment cruising was completed in Benewah County, Idaho, during September. Mapping in place continued during the month. It is expected that the half-million acres of forest land within the county will all be mapped this field season.

Several days were also spent in the field on one company's holdings checking the possibilities of using the Forest Service air photographs of this area in connection with the mapping in place. The photographs taken from an elevation of 15,000 feet are exceptionally good. The scale is a little less than four inches to the mile. Section lines and corners can be quite readily located on the pictures from the ground, and in many cases individual trees seen on the ground can be definitely located on the picture.

Logging and Milling Studies

The Anaconda Copper Mining Company selective logging study is progressing rapidly. Three separate plots of ponderosa pine, representing (1) clean-cutting practice, (2) economic selection and (3) Forest Service selection, are included in the study. A marking board composed of Watts, Koch, Weidman, and Anderson have marked the timber for cutting on the Forest Service plot. Neff, Anderson and Bradner will represent the Forest Service on the marking committee for the economic selection plot, in company with Mason of the Polleys Lumber Company and Clark of the University of Montana Forest School.

The minimum profitable tree size limit to be used on the economic selection plot has been tentatively set at 21" d.b.h.

Decay Resistance of Treated Timbers

The 1932 inspection of the railroad test track near Thompson Falls, Montana, was made. This test track was established in October, 1915, to determine the comparative durability of Douglas fir, white fir, ponderosa pine, lodgepole pine and western larch ties when laid under similar conditions of service in main line track. A total of 1675 ties, of which 1575 were creosoted according to the standard practice of the railway company and 100 were untreated, were laid. All untreated ties, consisting of 50 Mt. Douglas fir and 50 western larch laid on the 2° curve at the west end of the track, were replaced during the period from 1921 to 1926 on account of decay. A summary showing replacements of creosoted ties during the past 17 years is given below:

Species	No. ties set	Ties Replaced, by Causes: Mechanical wear and splitting		Decayed and split		Plate trouble		Total renewals	
	No.	No.	%	No.	%	No.	%	No.	%
Mt. D. fir	395	7	1.8	15	3.8	14	3.5	36	9.1
Larch	372	10	2.7	2	0.5	4	1.1	16	4.3
Lp. pine	199	3	1.5	2	1.0	9	4.5	14	7.0
White fir	200	7	3.5	2	1.0	4	2.0	13	6.5
Pon. pine	409	-	-	-	-	40	9.8	40	9.8
Totals	1575	27	1.7	21	1.3	71	4.5	119	7.5

All ties designated as removed because of "plate trouble" were sound ties which will be eliminated when computing the average life for each species at the end of the test.

In comparing the durability of the different woods after 17 years of service, it is found that the sawed ponderosa pine ties are still making the best showing both on the tangent and on the curves. All of the other species show much more deterioration from splitting and a smaller percentage free from large checks. Over 70% of the hewed lodgepole pine ties are badly split. However, the resistance of this species to plate wear appears to be fully equal to that of the Douglas fir and larch ties. From the standpoint of bad splits and checks, the hewed white fir ties appear to be in slightly better condition than the lodgepole, but this is more than offset by the excessive plate wear in the white fir.

Another inspection, covering the Northern Pacific test track at Missoula, was made. When established in the spring of 1910, this installation included 1072 western hemlock and 728 ties of other species treated with 80% grade I creosote and 20% refined tar. Only 124 of the hemlock and 45 ties of other species have been replaced. Judging from the low percentage of renewals (11.4%) in 22 years and the relatively small number of replacements in 1932, it is reasonable to expect an average life of at least 26 years from these western hemlock ties. The results of this test were given consideration when the Northern Pacific removed all restrictions on the acceptance of western hemlock ties.

Four reports containing service records of arsenic-treated timbers on the Absaroka, Gallatin, Helena and Deerlodge Forests were received through the Forest Supervisors in September. A report on the experimental fence posts at Miles City, Montana, inspected by Whitney in the latter part of June, has been partially prepared.

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PACIFIC NORTHWEST FOREST EXPERIMENT STATION

Experimental Forests and Natural Areas

The Wind River Experimental Forest and the Quinault Natural Area have recently been approved by the Forester. The Wind River Experimental Forest consists of a 10,000-acre tract of typical Douglas fir timberland within the Columbia National Forest, and includes 3500 acres of young growth, 2000 acres of old burn, and 4500 acres of old growth timber, 1200 acres of which will be set aside as a natural area. The experimental forest joins the existing Wind River Branch Station, which will serve as a headquarters.

The Quinault Natural Area consists of 1400 acres of old growth timber typical of the spruce-hemlock fog belt type. It lies within the Olympic National Forest one mile from Lake Quinault. The tract includes one of the best remaining old growth stands of this type. Some of the finest Sitka spruce obtained by the United States Government for airplane construction during the World War was cut on adjoining areas.

Proposed Natural Area and Experimental Forest in the Fog Belt Type

Kolbe spent several days in August on the Siuslaw Forest in search of possible tracts suitable for use as an experimental forest or for a natural area. A thousand-acre tract of old growth spruce and hemlock at Cape Perpetua on the Oregon Coast was found to be admirably suited for a natural area. Another piece of national forest land in this type having approximately 3500 acres of second growth spruce and hemlock gives promise of being the best area available for an experimental forest, but action for its withdrawal will be held up until other possible tracts have been more carefully examined.

The Wind River Arboretum from 1912 to 1932

In July, Munger and Kolbe compiled and analyzed in a report the data obtained during the past twenty years from the plantings in the Wind River Arboretum. This report reviews the history of the project and gives the status of the 1684 specimens representing 108 species of conifers and 39 species of deciduous trees. To date over 450 separate lots of seeds or stock were acquired since the establishment of the Arboretum in 1912.

Forest Survey

Judging from the number of advance requests for data collected by the Forest Survey, the final results will be in great demand. The generalized county type maps made primarily for the use of the State Agricultural Experiment Stations are attracting particular interest and many other agencies are now using them.

Progress on Lands Other Than National Forest - During the months of June, July, August and September, mapping in place was completed in six counties: Briegleb completed mapping Clackamas County, Bolles completed Mason County, Buell finished Pierce County, Kemp finished Lane County, and Moravets finished Snohomish and Skagit Counties. Type mapping is in progress in seven counties, and field work has yet to be started in only two counties. Progress of the adjustment cruising is equally satisfactory, and this phase of the work is over 90 per cent completed.

Compilation of the basic type and volume data for the inventory phase of the Columbia River Oregon Release Unit, consisting of six counties has been completed. This job was undertaken this summer in order that the technic might be completely developed for use this winter.

Progress on the National Forests - Field work has been completed on all but one of the west side national forests and that forest will be completed within the next two months. Check cruising of the national forests has been under way all summer and will be completed within a month. Office work remains to be done on parts of five forests and will be completed early this winter.

Fire Studies

The lightning storm study has been completed. The field work for the fire depletion phase of the Forest Survey has progressed according to schedule and will be completed about November 1. The target visibility data obtained last season have been analyzed and preparations made to begin work on analysis of records for this season. An improved signal bomb for calling road and trail crews to the telephone has been developed. The use of wood cylinders as an index of seasonal or accumulated fire hazard is being tested on six forests this summer. The hour control analyses were completed in July. Lack of smoky weather at Wind River has prevented the completion this year of the "radius of visibility" studies, but it was definitely determined that the effect of the sun on visibility of smoke from small fires is not as great as was expected within the 15-mile radius in use. It was also found that air transparency is the most important factor when volume of smoke is held constant. A simple method was developed for lookouts to measure this factor. Matthews and McArdle are now engaged in completing the field work for the Douglas fir slash disposal study.

New Public Domain

Delinquency status of lands in and adjacent to forest areas has been taken in ten counties; Office computation of total area delinquency in the ten counties is nearing completion and should be available in October. Field data of a more intensive nature have been taken in selected areas and, with supplemental data, will soon be ready for office analysis. In general, trends in reversion are more ominous than previously thought. Some of the findings have been put to early use by county and state officials.

Mensuration

Douglas Fir Volume Tables - A mimeographed circular of volume tables for old growth Douglas fir was given general distribution in August. This circular is the result of Meyer's work in the Washington Office last winter, when representative data from all the regions in which Douglas fir occurs were gone over with the intention of producing a set of volume tables which would apply to the entire range. The study resulted in the division of the data into two major groups, one containing the better sites of the North Pacific Coast, and the second the poorer sites of the interior country, including the Rocky Mountain form.

Ponderosa Pine Growth Study - The first draft of the manuscript of the growth study, which has been under way at this Station for the last four years, has now been whipped into shape. The problem of predicting growth in the selectively cut stands of ponderosa pine has been presented in a way which will make the actual process of growth prediction a simple matter.

The portion of the general growth study dealing with even-aged stands is now being expanded to cover the entire range of the species. Contacts have already been made with several regions for the collection of suitable data.

Silviculture

Douglas Fir Silviculture - The periodic examination of reproduction plots throughout the Douglas fir region in Washington and Oregon disclosed a very light crop of 1932 seedlings. However, conditions for survival during June and July were favorable for existing reproduction, and for the first time since 1923 there is a fairly good cone crop on old growth Douglas fir over most of the region. Where physical factors are being measured in the Wind River Valley, the loss of 1932 seedlings was low during the early part of the season, but rose to 75 per cent during the August drought period and is still climbing.

On the Cascade Forest an area cut in 1925 developed such a heavy cover of peavine, blackberry, snowberry, etc., as to preclude restocking. Good seed crops had not followed cutting. This year the area was heavily grazed by sheep in an effort to reduce the cover in advance of the oncoming seed crop. An area has been fenced, and it will be interesting to compare the development of cover and reproduction on the protected area and outside.

In reproduction studies there has been a long felt need for a measure of the effect of a slash fire on the soil, and an arrangement has been made with Washington State College to obtain such a measure. The Station will select and sample typical areas, then burn the slash and resample the areas, and the State College will make the soil analyses. The areas have been selected, the first sampling has been done, and the slash will be burned as soon as conditions permit.

Cone crop reports - Early in August the Station received from one or more rangers on each of the national forests reports on the cone crop of the more important timber trees in the region. Generally throughout the region, Douglas fir is producing a medium crop of cones this year, as is also true of Sitka spruce, western hemlock, sugar pine and western red cedar. The ponderosa pine crop is erratic with some localities producing many cones.

Section of Forest Products

A conference of some of the Station staff, Regional Office men, and other interested individuals resulted in the formulation of a tentative system of log grades for Douglas fir which are more closely correlated with log conversion values.

Douglas Fir Mill Scale Studies - Field work in connection with two Douglas fir mill scale studies was completed. A total of 2,200 logs were tallied through the mills, 700 at the Southeast Portland Lumber Company, Portland, Oregon, and 1,500 logs at the J. H. Chambers & Son mill, Cottage Grove, Oregon. The data are now being prepared for punching on Hollerith machine cards.

Motor Truck Logging - Rapraeger and Lodewick spent a week in the Coos Bay Region starting field work on the trucklogging study. Since then Rapraeger has surveyed the Douglas fir and pine regions.

Motor truck logging is a subject of ever-increasing interest in Oregon and Washington. In Oregon alone, 417 trucks were used in logging in the year ending June 30, 1932, the vehicles ranging from low priced 1-1/2 ton units to 11 ton trucks equipped with water cooled, air controlled brakes. One large operation is trucking 200 million feet of logs to tidewater and another, 150 million feet. Most operations are considerably smaller, but the fact remains that motor truck logging is not limited to the small "gippo" logging show. Brandstrom believes that trucks, under certain conditions, should be part of the transportation system on large scale operations practicing selective logging where their flexibility will be a great asset to the logger.

In the requirements phase of the Forest Survey, Portland building permit applications for 1921, 1926, and 1931 were studied to find volume, material, cost distribution and trend for the various classes of buildings in Portland. Material lists for forty small garages and fifty-four selected residences and other buildings were used in computing conversion factors between board footage of lumber used and volume of new construction of the various classes. Two thirds of the repair permits for the first six months of 1932 were sampled to find the amount of lumber used for repair work. A demolition curve was worked out from the records for 230 blocks of the oldest part of Portland.

The basic information for Portland will be applied, with checks, to volume of construction figures from all the cities in the region. Field work in Oregon cities and in Tacoma, Washington has been completed. Material used by the Portland Dock Commission, Port of Portland, and the U. S. Army Engineers for the past four years has been secured. Public utility companies and the city engineer's office have furnished estimates and figures on public utility and city needs for street and improvement work.

The depletion cutting phase of the survey, is now well under way. Tabulations of the information available in the Products files is nearly completed. Considerable difficulty is being experienced in determining the depletion by counties, particularly those bordering on tidewater, because of the interchange of logs between such counties and incomplete data on log production for past years.

Lumber, Lath, Shingle, and Log Census - The 1931 census of lumber, lath, shingle and log production in Oregon and Washington was completed the fore part of August. A total of 1,895 schedules were received, edited, and forwarded to Washington.

Bigleaf Maple Bulletin - Johnson's report "Utilization of Bigleaf Maple of the Pacific Northwest" has been published as Circular No. 225.

Forest Insurance

Practically the entire month of June and the early part of July were devoted to the completion of the text of Progress Report Number One covering the Douglas fir region.

In July preparations were made for extending the study into the ponderosa pine region.

After 10 days of preliminary reconnaissance by Shepard, actual field analysis work began with Perry Emigh, an experienced cruiser, as assistant and has been in progress since. Shepard spent 20 days in the field with Emigh.

If a fire was entirely or practically entirely confined to noncommercial types, if there has been unsystematic salvage, if there has been logging and slash burning on or directly adjacent to the area since the fire, or if it is otherwise than definite and clear cut, it is not possible to get usable data from it. In some sections this means that the majority of the burned areas have to be discarded.

Up to the end of September approximately 12,700 acres had been covered in detail on 17 separate burned areas. It is hoped that by the end of the field season it will have been possible to cover between 25,000 and 30,000 acres on at least 30 burns.

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SOUTHERN FOREST EXPERIMENT STATION

Naval Stores

Starke. A review of the width-of-face tests showed that although lower yields were obtained from narrow faces than from wide ones the former showed a relative increase over the latter for the period of turpentining. In one test wide-faced longleaf trees for three years gave 20 per cent more gum than those with narrow faces. Another test in longleaf over five years showed the wide-face yields to be 14 per cent more than the narrow. A third test in slash pine gave a 6 per cent greater yield from wide faces than narrow over a 5-year period. In these tests the narrow faces covered one-fourth of the bark circumference and the wide faces covered three-eighths.

A comparison was made of yields from slash pine chipped at Sampson and Dukes in east Florida and at Kiln, Mississippi showed the Kiln yields to be from 8 to 33 per cent greater for various diameters than the yields from the corresponding sized trees at Sampson and Dukes. The yields from the two latter localities were almost identical. In all cases the site was the same, 85 to 90 feet. Some records for longleaf were obtained from Kingsley and Union in east Florida and the Choctawhatchee Forest in West Florida. The Kingsley and Union yields were very nearly the same but the Choctawhatchee yields were somewhat higher. The timber-growing sites were 45 feet for the Choctawhatchee and 70 feet each for the Kingsley and Union tracts. This seems to indicate that timber-growing site is not at all correlated with gum yields.

The 50 trees at Kingsley on which French and American faces were placed gave rather contradictory results. For the first two years the French faces furnished a higher yield than the American and during the last two years the situation was reversed. For the 4-year period the French faces were 6.6 per

cent ahead of the American. The probable reason for the change in relationship was the change in depth of chipping at the beginning of the third year on the French faces caused by a change in tools. The trees chipped with two French faces in the thinning plots at Kingsley gave very poor yields for two years, averaging 43 and 33 ounces per tree for the first and second year, respectively. These trees were arranged by inch diameter classes and it was found that it took a 7-inch tree to yield as much as 20 barrels of spirits per crop. Eight-inch trees yielded nearly 30 barrels. However, it should be borne in mind that these were really paired faces.

By the end of September, 27 streaks had been cut on turpentine trees at Starke. An analysis of the best group of slash pine trees shows that there has been a pronounced falling off in yield during 1932 from the yields of the previous two years. So far this year the yields have been 17 per cent under the yields for the corresponding period in 1931 and 10 per cent under the 1930 yields for the first 28 streaks. It is believed that this can be accounted for only by the effects of the dry season, which ran from the last part of the 1931 season through the spring of 1932.

This is further borne out by the fact that slash pine trees continue to be attacked by Ips and during September, 5 or 6 additional trees died, including 2 of the largest trees in the stand, which were unturpentined trees in our check group. The longleaf trees have been less affected by the dry weather. At least there has been less insect damage at Kingsley than there has been at Sampson.

Financial Aspects of Private Forestry

Supplementary to work done in 1930 by Bond incooperation with the Forest Taxation Inquiry, timber strips were run 6 miles apart across Beaufort County, North Carolina. This additional work will make the Financial Aspects study of Beaufort County comparable to the other county studies.

Erosion

Black locust planted in 1930 on the Natchez Experiment Station farm were pruned and some trees cut back, and experiments were made to test the effect of this treatment on growth. This small plantation is very thrifty and shows a good height growth of 12 to 20 feet, for planted trees approximately 2 years old.

During the spring of 1932, several gullies on the Holly Springs experimental tract were planted to trees and other soil-binding vegetation. During the summer additional work was done to sod the bottoms of these gullies with several species of soil-binding grasses. Bermuda grass, Johnson grass, and Paspalum dilatatum were used.

Forestation

Early in the summer Wakeley completed a series of referee germination tests of southern pine seed conducted in the spring of 1931. A private company, a Federal bureau, an endowed research institution, three forest schools, and a forest experiment station joined the Station in simultaneously

testing by many different methods the germinative capacity of carefully matched seed samples of slash pine, loblolly pine (both fresh and stored), shortleaf pine, and pond pine. The results showed clearly that stratification in moist acid peat at low temperatures improved the rapidity and completeness of germination. (The acid peat stratification method was originally developed at the Boyce Thompson Institute.) Acid peat showed great promise as a germinating medium, with or without previous moist, cold stratification of the seed.

In August the second annual cone crop estimate for the southern pine region was completed, using as a basis approximately 100 separate species reports sent in by members of the Society of American Foresters. The 1932 crop is in general light and in many places a failure, but cones of each species are abundant in a few widely separated places.

An estimate indicates that perhaps 6,700,000 acres will not restock in 20 years without planting, that nine-tenths of one per cent of this area has already been planted, that one lumber company alone has done nearly half the planting in eight States, cheaply and with excellent results, and that State and Federal planting and planting by more than a thousand private agencies is most disappointing in total area and in degree of success attained.

Protection, Fire

Lake City. The depth of litter measurements in southern pine stands made by the Station from 1923 to 1931 were analyzed. The basic data were taken from 46 area, 18 of which were shortleaf or loblolly pine; 8 were slash, slash-loblolly or slash-longleaf pine; and 20 were longleaf pine. The following results were obtained:

1. The curve of litter depth over number of years of complete protection from fire with average of all species showed that the stands reached their greatest litter depth (1.75 inch) at 16 years of complete protection from fire and,

   a. after that time it indicated that an equilibrium had been reached, the decay balancing the accumulation.

   b. before that time it showed that the accumulation was at the following rate:

2 years	= 1.00 inch
4 years	= 1.32 inch
6 years	= 1.51 inch
8 years	= 1.63 inch
10 years	= 1.69 inch
12 years	= 1.72 inch
14 years	= 1.74 inch
16 years	= 1.75 inch

2. Different species were found to have different litter depths for the same period of protection. Longleaf pine averaged .41 inch deeper than shortleaf or loblolly pine; and slash pine, either plain or in mixture with loblolly or longleaf pine, averaged .68 inch higher than shortleaf or loblolly pine. The slash pine group was represented by only 8 areas, most of which were very dense stands of slash pine, which probably explains why it showed a higher reading than longleaf. Based on size of needles the slash pine group should be between the shortleaf-loblolly pine group and the longleaf pine group.

Forest Survey

Hardwoods - upland. During the summer, office analysis of the upland hardwood data proceeded as rapidly as was possible, considering interruptions caused by detail of personnel to work on the Copeland Report. The analysis made of the line tally showed only 23.37 per cent of the region forested and 76.63 per cent non-forest. Over 30 per cent of the non-forest land was tallied as eroding. The idle and abandoned areas showed 25.44 per cent and 47.5 per cent respectively as eroding. On the abandoned land over 25 per cent was gullied.

The following table shows the type and percentage of erosion for each land type.

SUMMARY EROSION UPLAND HARDWOODS
From
TOTALS AND PERCENTAGES
FOR TYPES OF EROSION

Land Type	Per Cent of Area	No Erosion: 1	Sheet: 2	Shoestring: 3	Gully: 4	Ext. Gully: 5	Controlled by Tree Growth 6
Forest	23.37	69.01	2.29	.64	1.53	.32	26.21
Farm Land	36.67	77.13	17.90	2.28	2.26	.43	..
Pasture Land	12.33	51.36	27.64	5.09	9.85	5.53	.53
Woodland Pasture	3.86	69.62	14.89	4.06	6.47	4.21	.75
Temp. Abandoned Land	5.65	74.56	17.28	3.88	2.38	1.90	..
Permanently Aban. Land	16.48	52.50	17.94	3.91	12.04	13.40	.21
Other Land	1.64	92.12	4.55	.30	.61	2.42	..
Total Non-forest	76.63	67.26	19.01	3.27	5.84	4.44	.18
Total All Land	100.	67.70	14.80	2.61	4.76	3.41	6.72

Hardwoods - bottomland. The field work in the Delta portion of Mississippi was completed. Aerial photographs were found to be very helpful to the field crews. Aerial maps were helpful but not as desirable as the actual photographs, for:

1. Features left off the maps are often the very things which would prove most useful if they were included.
2. Roads, timber boundaries, etc., are distorted when transferred to maps from photographs.
3. Photographs are on larger scale, and therefore show more detail.

Several unusual conditions were encountered where one crew was gathering data for cypress-tupelo gum volume tables. One hundred trees were measured, with the aid of the Liljenstrom dendrometer, in a tupelo and cypress brake where the water level was knee high and early in the spring was over 8 feet high. Faulks prepared a set of tables for making all measurements 59 feet from the tree and for varying stump heights. Due to the "swell butts" the stump height was often 6 or 8 feet above the water level. The "d.b.h." was taken as being 30 inches above the designated stump height. The ratio between this point and the d.i.b. top of the first 16-foot log was found to be 55 per cent. Lehrbas and Faulks prepared a volume table from measurements on 54 tupelo, using a 2-inch taper for each 16-foot log above the first log. The ratio for cypress was found to be 68 per cent.

Pine phase. Work was resumed by one 3-man crew in the shortleaf-hardwood region of northeastern Mississippi on August 29. This crew continued the work begun during the high water season last spring.

Hardwood Growth and Yield Study

Field work on this study continued throughout the summer, and 61 plots were established in fully-stocked, even-aged red gum stands. These stands are largely found on abandoned fields.

Red gum seems to come in on abandoned fields from two sources. One is seed, the other, stump and root sprouts on land abandonad shortly after clearing and before the roots and stumps have been entirely removed. Associated with the gum in old-field stands are cottonwood, honey locust, persimmon, willow oak, lowland black oak, Shumard oak, pecan, and occasionally cherrybark oak and sycamore. In many of these stands the oaks make up too large a proportion of the stand or monopolize so great a proportion of the crown space to permit the establishment of satisfactory gum plots.

The results of the field work of the red gum growth and yield study are revealing some surprisingly rapid rates of growth in stands originating on old fields. One 1/3-acre plot, established in a 20-year-old stand on Wabash clay soil, bore 216 living trees having an average diameter of 6.6 inches and dominants and codominants averaging 73 feet in height.

Evidences of fire are present on practically all sample plots. Where fire scars are not actually present or obviously overgrown, the paired occurrence of many stems indicates that the stand originated by sprouting from a young stand previously fire-damaged.

The prevalence of luxuriant vine growth causes a considerable amount of damage to old-field red gum stands. Instances have been observed where fires of insufficient intensity to seriously damage standing trees have killed the vines.

Forest Pathology

Late in the growing season, Siggers visited the Louisiana State Nursery at Woodworth to inspect some seedlings of Asiatic chestnut that have now attained a height of about 3 feet. He reports that they are remarkably free from the leaf blight, and are in a very thrifty condition.

Actual determination of height growth on sprayed and unsprayed longleaf pine seedlings at Bogalusa, Louisiana, indicates that seedlings sprayed to control brown-spot have a greater annual height growth than unsprayed seedlings. Bordeaux mixture and several lime sulphur compounds were used in the preparation of sprays.

Forest Products Pathology

Several commercial scale tests of a number of new lumber-dipping treatments for the control of sap stain and mold which had shown considerable promise in preliminary tests last spring were established at 12 representative pine and hardwood mills. Public service patents have been applied for in the case of the promising phenol compounds, and in the event that these are found effective in stain control they should enjoy a wider field of usefulness than present treatments on account of their lack of corrosiveness and less likelihood of injury to workmen handling them. Log treatment tests completed recently indicate that effective control of stain and marked reduction in insect damage over a storage period of several months can be obtained with these compounds.

The results just obtained from a test of three chemical spray treatments for the control of stain in export timbers shipped in the green condition are very promising. One of the treatments in particular was found to keep export stock shipped to London in a thoroughly bright and satisfactory condition.

A still wider field of use for effective chemical treatments for wood in the green condition is indicated by the present very satisfactory condition of the pole and piling stock given one of several experimental dipping treatments at the Shreveport, Louisiana Long-Bell Lumber Company plant. Heretofore it has not been possible to season such stock without creosote pre-treatment, and it seems quite possible from the results obtained so far that weaker solutions of certain chemicals will be found effective in controlling deterioration during seasoning and thus effect material reductions in pole and piling production costs.

Methods of Cutting Study

The reexamination of the 200-acre longleaf pine Method of Cutting plot near Bogalusa, Louisiana, indicates that a marked increase in growth of the residual stand begins about the third year after cutting, increases to a

maximum at about the fifth or sixth year, and gradually decreases thereafter. The scarcity of longleaf pine reproduction on this area is very apparent. Shortleaf pine reproduction is dense on scattered areas.

Ecology

A study of anatomy of longleaf pine seedlings showed: (1) No annual rings are present in longleaf pine seedlings as long as the seedlings remain in the grass stage; (2) annual rings begin to develop when the seedlings begin their period of rapid height growth. As long as the seedlings are in the grass stage, they seem to grow when environmental conditions are favorable, and do not show, therefore, a definite dormant and active growing season. When terminal bud is produced, a definite growing season is evident, resulting in annual rings.

New Public Domain

Field and office work on the New Public Domain project are moving forward. Attention is being paid to the following factors bearing on tax-delinquency and land abandonment: (1) variation in ratios of assessed value to sale value of land; (2) the location of tax-delinquent areas with respect to local market centers; (3) the increase in local tax-delinquency during the period 1927-1930.

Work done in Little River County, Arkansas indicates that the total "new public domain" in the county as of July, 1932 is 19,568 acres. About 90,000 acres more are delinquent but not yet certified. The county area is approximately 349,700 acres.

Of the approximately 454,000 acres in Washington County, Arkansas, nearly 100,000 acres have reverted to the State, and about 60,000 acres were delinquent in 1930.

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RESEARCH ACTIVITIES IN REGION 2

In the study of individual variation and inheritance in ponderosa pine, the first decade of June was employed in analyzing the sample tree material from the local 1928 series (2-2 stock) and from the Nebraska 1929 and 1930 series (2-1 and 2-0 stock respectively). In addition to procuring measurements on height growth and stem development, the oven dry weight of the tops of the trees was also obtained. A total of 869 trees was thus studied.

The results failed to definitely substantiate, for the Nebraska study, those obtained in previous tests which indicated a direct relationship between early seedling and transplant development and distance of seed source from the planting site. The largest trees were procured from the seed of an exceptionally vigorous seed tree in the middle of the range of distribution (about 200 miles from the Bessey Nursery), while the smallest progeny came from a tree relatively close to the nursery. In the 2-0 stock the average dry weight of stock from individual parent trees from within the plantations

themselves varied between 3.68 and 11.53 grams, and the standard deviation between ± 2.51 and ± 4.41 grams. While it is apparent that the vigor of the parent tree may more than offset the results of unfavorable geographic location, it is interesting to note that the average dry top weight of 41 two-year seedlings from the Nebraska plantations was 6.73 grams, while that of 61 seedlings from Pine Ridge trees in Wyoming at the farther end of the range of distribution of the series weighed only 3.66 grams. A few Black Hills trees were represented and showed very good development, which is of interest from the standpoint of the present Nebraska seed collecting policy.

In the Fremont study, represented by 2-2 stock, the average dry weight in grams of progeny from parent trees at 7,000, 7,500, and 9,000 foot levels was found to stand in the ratio of 13, 9, and 5. The average weight of the Strain A (mistletoe-resistant) progeny amounted to 5.34 grams, as against 7.56 grams for that from mistletoe-susceptible and doubtful trees. And tending to substantiate the theory of hybrid vigor, progeny obtained by artificial crossing in Strain A yielded an average weight of 8.23 grams.

During the last decade of the month the annual Engelmann spruce and ponderosa pine flower counts were made in the seed production studies, Fs-146 and 101(c). For both species 1932 proved to be an "off season" which may, to some extent, be attributed to the prolonged drouth, which by this time had been in existence almost one year. 24% of the spruce trees on the experimental area bore flowers, the average crop amounting to 13.6 flowers per tree or 1230 per acre in a 70 year old small pole stand.

In ponderosa pine, only 19% of the trees on the experimental area produced flowers, and the crop of 27 flowers per tree was extremely light. Some of the failure to produce may be attributed to a morphological condition created by the wholesale cutting of branch terminals last fall by squirrels while harvesting the 1931 cone crop. This also resulted in greatly reducing the potential 1932 crop. It is estimated that almost 50% of the branch tips were cut off on the .6 acre area.

Shortly after the first of July the seed tests of the individual cone lots in the ponderosa pine cone development study, 1931 crop, were concluded. The data were compiled in August, and included the chronological rate of development of cones, also the relation of the number of seeds per cone and germination to cone weight and size and to the number of cones produced in a cluster. The results indicate that the period of maximum growth (in length) occurs between mid-June and the first of July during the second season, that 97% of full size is attained by July 20, and that about 5% of the entire growth is made between the end of the first growing season (9/11) and the middle of May (5/16) of the second season.

Several days were spent during the early part of July in reviewing reports and preliminary graphs and tables in the administrative strip survey yield study based on accretion borings. The final Black Hills table was submitted for review, as also were Supervisor Pearce's yield statistics for the Holy Cross, Rio Grande, Uncompahgre and Gunnison spruce type studies. In addition, Pearce's harmonization and prediction curves for the White River study were analyzed and corrected.

About this time the mid-summer examination of the 1932 high and low elevation plantations in the source of seed study for ponderosa pine (Fs-101(d), Phase 3, Fremont) was made to determine the amount of survival during the most severe summer drouth in the history of the station. Losses at this time in the lower plantation (7000') amounted to 27.4%; in the high elevation plantation (9100') to 13.7%. In both the progeny from the seed tree growing at the lower limit of distribution were most heavily hit, probably because of their much larger size. It was interesting to note that the young trees from high-elevation parent trees were more prompt in starting new growth; in fact, the percentage of "growing" trees in both plantations increased with increasing elevation of the growing site of the parent trees. It is assumed that this paradoxical phenomenon reflects a peculiar growth condition induced by an extremely serious drough situation rather than any normal condition of development. To save the two plantations and also the two other spring plantations in the individual variation study at Fremont, recourse was had to artificial watering - probably the first time any field plantation was thus treated.

Practically all of the field work performed in August was given to the experimental forest management project. The stand on five .92 acre plots in management unit Block B was marked, mapped and measured and subsequently cut-over. The type includes Douglas fir sapling thickets interspersed with more extensive open areas of mixed all-aged ponderosa pine and Douglas fir. During this period Williamson completed the thinning of the two remaining plots in Block C which had not yet received their first cut. These plots yielded a heavy cut of fuel wood aspen, estimated at five cords per acre.

At the close of the month Plot B-3, in a 75 year old pole and sapling stand predominantly (79%) Engelmann spruce with Douglas fir as the principal associate, which was thinned to 900 trees per acre in 1927, was remeasured. The stand, which is mostly even-aged with a few scattered mature Douglas firs, came in following a severe fire about 1850.

The figures show a favorable margin of diameter accretion for spruce over Douglas fir above the 2.0-2.9" diameter class. Most of the trees in the small diameter classes (up to 3") probably will play no part in the future stand and should have been eliminated in the original thinning to provide more light for reproduction which is not coming in and which should be encouraged to provide the lowest story in a three age-class selection forest under management.

During the first week in September, the first decade remeasurement of Plots C-20, 36 and 37, the first areas to be cut-over under the present management plan, was made. On the two latter plots losses resulting from winter killing more than offset the periodic increment. Within that part of the experimental forest under management this damage was confined to a limited area on the lee side of a wind swept ridge where the soil is shallow and conditions very favorable for its occurrence. Destruction was greatest in clumps of trees, and this situation provides the basis for the belief that drouth, in addition to winter killing, caused the dying of the trees. 33 trees out of 635, 40% of which were over 6" d.b.h., were thus destroyed and again as many were seriously retarded in their growth by the loss of all their foliage except that of the current season.

At the close of the growing season on September 10, the routine fall cone counts and collections were made in the local Douglas fir, Engelmann spruce and ponderosa pine seed production studies. In the case of the last named species, only 13% of the immature (1-year) cones present in the spring developed to maturity. The normal expectation lies between 80-90%. This condition most likely is another drouth reaction, occurring as the result of diminished physiological activity on the part of the trees.

On the quadrats established in October, 1931, to study the course of natural reproduction and the result of artificial reseeding on the area burned over by the disastrous Rochford Fire in the Black Hills (the largest fire in the history of Region 2), a complete inspection was made to determine not only the number of seedlings present, both natural and as the result of sowing, but also the density, distribution and species representation of the herbaceous ground cover which has established itself since the original cover was completely destroyed. The number of ponderosa pine seedlings resulting from sown seed is disappointingly small. While some seed was washed away, it is probable that birds and rodents consumed most of the seed which was sown. One clump of natural seedlings was found, which originated from seed washed out from a squirrel horde not entirely consumed by the fire. The herbaceous cover has developed on all portions of the burned area, in some cases completely covering the ground with a mat of vegetation a foot or more thick. The first and most profuse occupant of the ground, especially on east and north slopes, has been and is geranium. Aster, daisy, horsemint, snowberry, and spireae are some of the first year associates of geranium which are reclothing the soil with a cover which is not only checking the early progress of sheet erosion which is everywhere in evidence on the burn, but which is also providing a desirable seed bed for coniferous reproduction. The situation with respect to seed trees in the vicinity of the Dumont quadrats is encouraging since the majority of the occasional patches of badly scorched trees which did not "crown" in the fire and which it was anticipated would eventually succumb, have survived.

Photos were taken of the destructive erosion along the South Rapid Creek Road, the direct and very evident result of burning over the numerous small watersheds which drain into this stream. Washed out road culverts, deeply gullied gulch channels, and large detrital fans, from a few inches to four feet thick, on valuable meadow land, following a few heavy but not abnormal rains during the first summer after the fire, constitute the best possible evidence as to the effectiveness of a forest cover in preventing erosion.

Miscellaneous

During the past season porcupines have become very destructive in the ponderosa pine plantations at the Fremont Station. The control campaign which was instituted included hunting and killing the rodents and placing out strychnine poison blocks throughout the experimental forest. These blocks were furnished by the Biological Survey. During his May visit, Mr. G. A. Pearson was impressed by the extensive evidence of porcupine activity and destruction throughout the Region.

Visitors

Dr. H. H. Chapman visited the Fremont Station in June. He was especially interested in the results of the Douglas fir cutting methods experiment which was started in 1915, and was impressed by the very satisfactory stand of natural reproduction which has been procured under shelterwood and the relative failure to restock following clear-cutting on an area 200 feet square and entirely surrounded by seed trees. The presence of aspen under heavy virgin stands and the rapidity with which this species spreads and develops from root suckers when the virgin stand is cut, and not till then, also attracted his attention.

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FOREST TAXATION INQUIRY

The time of the staff has been devoted to the writing of the comprehensive report and to formulating plans for taxing forest lands.

A very helpful conference was held August 2 to 5, attended by Messrs. Clapp, Marsh, Granger, Kirkland, Eldredge, Roberts, and members of the Inquiry staff. The plans of forest taxation which the Inquiry staff are considering as the most promising were informally presented and discussed. The advantages and disadvantages of each plan were brought out, and many useful suggestions received. The discussion involved the broad fundamental principles affecting the practice of forestry on privately-owned lands and their special relation to taxation, as well as fundamental taxation principles. It was especially helpful to the members of the Inquiry staff in giving them a better realization of the points that will have to be cleared up in its comprehensive report and of the reaction of the forestry profession to the recommendations which it has under consideration.

The discussion in the lumber trade press of extracts from a preliminary draft of a report to the Timber Conservation Board by the Subcommittee on Taxation headed by Fairchild seemed to call for an authoritative statement to correct certain false notions as to the relative importance of taxation among the causes of the current heavy liquidation of timber. Accordingly a paper was prepared by Fairchild entitled, "Taxation and Timber Operation," which it is expected will be published in the September number of the West Coast Lumberman. This paper in no way minimizes the importance of taxation as a secondary cause of liquidation and as an obstacle in the way of the business of forest growing.

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